

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>49617</b>	<b>FOR FURTHER ACTION</b>	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. <b>PCT/FI 00/00280</b>	International filing date ( <i>day/month/year</i> ) <b>31 March 2000</b>	(Earliest) Priority Date ( <i>day/month/year</i> ) <b>1 April 1999</b>
Applicant <b>NOKIA NETWORKS OY</b>		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1.  Certain claims were found unsearchable (See Box I).
2.  Unity of invention is lacking (See Box II).
3.  The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
  - filed with the international application.
  - furnished by the applicant separately from the international application,
    - but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
    - transcribed by this Authority.
4. With regard to the title,  the text is approved as submitted by the applicant.
  - the text has been established by this Authority to read as follows:
5. With regard to the abstract,
  - the text is approved as submitted by the applicant.
  - the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:
  - Figure No. 3  as suggested by the applicant.
  - because the applicant failed to suggest a figure.
  - because this figure better characterizes the invention.
  - None of the figures.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00280

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: H04L 1/22 // H 04 B 1/74**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: H04L, H04B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0696111 A2 (NIPPON TELEGRAPH AND TELEPHONE CORPORATION), 7 February 1996 (07.02.96), column 2, line 36 - column 3, line 28, claim 1, abstract --	1-10
A	1999 IEEE International Performance, Computing and Communications Conference, page 370 - 376, This Conference was Held: 10-12- Feb. 1999, ISBN: 0-7803-5258-0, Andreas Isele: "A New Synchronization Algorith for Hitless Protection Switching in ATM Networks", see Paragraphs 1.-2.1, abstract -- -----	1-10

 Further documents are listed in the continuation of Box C. See patent family annex.

- \* Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

23 August 2000

25 -08- 2000

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. + 46 8 666 02 86

Authorized officer

Bo Gustavsson/AE  
Telephone No. + 46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

08/05/00

International application No.  
**PCT/FI 00/00280**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0696111 A2	07/02/96	JP 2874112 B JP 9036826 A US 5631896 A	24/03/99 07/02/97 20/05/97

## PATENT COOPERATION TREATY

PCT

## NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year) 12 October 2000 (12.10.00)			
Applicant's or agent's file reference 49617		IMPORTANT NOTICE	
International application No. PCT/FI00/00280	International filing date (day/month/year) 31 March 2000 (31.03.00)	Priority date (day/month/year) 01 April 1999 (01.04.99)	
Applicant NOKIA NETWORKS OY et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:  
AG,AU,DZ,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:  
AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,  
GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,  
NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW  
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 12 October 2000 (12.10.00) under No. WO 00/60802

**REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)**

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

**REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))**

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. (41-22) 740.14.35	Authorized officer  J. Zahra  Telephone No. (41-22) 338.83.38
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Continuation of Form PCT/IB/308

**NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF  
THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES**

Date of mailing (day/month/year) 12 October 2000 (12.10.00)	<b>IMPORTANT NOTICE</b>
Applicant's or agent's file reference 49617	International application No. PCT/FI00/00280

The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.

**PCT REQUEST**

Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

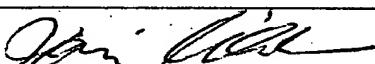
0-1	<b>For receiving Office use only</b> International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	<b>PCT-EASY Version 2.90 (updated 08.03.2000)</b>
0-5	<b>Petition</b> The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	<b>National Board of Patents and Registration (Finland) (RO/FI)</b>
0-7	Applicant's or agent's file reference	<b>49617</b>
I	Title of invention	<b>METHOD AND ARRANGEMENT FOR CHANGING PARALLEL SIGNALS IN A DIGITAL DATA TRANSMISSION</b>
II	Applicant	
II-1	This person is:	<b>applicant only</b>
II-2	Applicant for	<b>all designated States except US</b>
II-4	Name	<b>NOKIA NETWORKS OY</b>
II-5	Address:	<b>P.O. Box 300 FIN-00045 Nokia Group Finland</b>
II-6	State of nationality	<b>FI</b>
II-7	State of residence	<b>FI</b>
II-8	Telephone No.	<b>+358-9-51121</b>
II-9	Faxsimile No.	<b>+358-9-51168080</b>
III-1	Applicant and/or inventor	
III-1-1	This person is:	<b>applicant and inventor</b>
III-1-2	Applicant for	<b>US only</b>
III-1-4	Name (LAST, First)	<b>LAHTI, Harri</b>
III-1-5	Address:	<b>Hevontie 25 B FIN-01820 Klaukkala Finland</b>
III-1-6	State of nationality	<b>FI</b>
III-1-7	State of residence	<b>FI</b>

**PCT REQUEST**Original (for **SUBMISSION**) - printed on 31.03.2000 10:00:50 AM

III-2	<b>Applicant and/or inventor</b>	
III-2-1	This person is:	<b>applicant and inventor</b>
III-2-2	Applicant for	<b>US only</b>
III-2-4	Name (LAST, First)	<b>TORVINEN, Marko</b>
III-2-5	Address:	<b>Kilonpuistonkatu 3 A 16 FIN-02610 Espoo Finland</b>
III-2-6	State of nationality	<b>FI</b>
III-2-7	State of residence	<b>FI</b>
IV-1	<b>Agent or common representative; or address for correspondence</b> The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	<b>agent</b>
IV-1-1	Name	<b>BERGGREN OY AB</b>
IV-1-2	Address:	<b>P.O. Box 16 FIN-00101 Helsinki Finland</b>
IV-1-3	Telephone No.	<b>+358-9-693701</b>
IV-1-4	Facsimile No.	<b>+358-9-6933944</b>
IV-1-5	e-mail	<b>email.box@berggren.fi</b>
V	<b>Designation of States</b>	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<b>AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</b> <b>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</b> <b>EP: AT BE CH&amp;LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</b> <b>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</b>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<b>AE AG AL AM AT AU AZ BA BB BG BR BY CA CH&amp;LI CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</b>

**PCT REQUEST**

Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

V-5	<b>Precautionary Designation Statement</b> In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	<b>Exclusion(s) from precautionary designations</b>	<b>NONE</b>	
VI-1	<b>Priority claim of earlier national application</b>		
VI-1-1	Filing date	<b>01 April 1999 (01.04.1999)</b>	
VI-1-2	Number	<b>990739</b>	
VI-1-3	Country	<b>FI</b>	
VI-2	<b>Priority document request</b> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	<b>VI-1</b>	
VII-1	<b>International Searching Authority Chosen</b>	<b>Swedish Patent Office (ISA/SE)</b>	
<b>Check list</b>			
VIII-1	Request	number of sheets	electronic file(s) attached
VIII-2	Description	<b>4</b>	-
VIII-3	Claims	<b>9</b>	-
VIII-4	Abstract	<b>3</b>	-
VIII-5	Drawings	<b>1</b>	<b>49617.txt</b>
VIII-7	<b>TOTAL</b>	<b>8</b>	-
VIII-8	<b>Accompanying items</b>	paper document(s) attached	electronic file(s) attached
VIII-9	Fee calculation sheet	✓	-
VIII-10	Separate signed power of attorney	✓	-
VIII-11	Copy of general power of attorney	✓	-
VIII-12	PCT-EASY diskette	-	<b>diskette</b>
VIII-13	<b>Figure of the drawings which should accompany the abstract</b>	<b>3</b>	
VIII-14	<b>Language of filing of the international application</b>	<b>Finnish</b>	
IX-1	<b>Signature of applicant or agent</b>		
IX-1-1	Name	<b>BERGGREN OY AB</b>	
IX-1-2	Name of signatory	<b>Joni Mikkola</b>	
IX-1-3	Capacity	<b>Patent Agent</b>	

**PCT REQUEST**Original (for **SUBMISSION**) - printed on 31.03.2000 10:00:50 AM**FOR RECEIVING OFFICE USE ONLY**

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported International application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	<b>ISA/SE</b>
10-6	Transmittal of search copy delayed until search fee is paid	

**FOR INTERNATIONAL BUREAU USE ONLY**

11-1	Date of receipt of the record copy by the International Bureau	
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**PCT (ANNEX - FEE CALCULATION SHEET)**

49617

Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

(This sheet is not part of and does not count as a sheet of the international application)

0	For receiving Office use only International Application No.		
0-2	Date stamp of the receiving Office		
0-4	Form - PCT/RO/101 (Annex) PCT Fee Calculation Sheet Prepared using	<b>PCT-EASY Version 2.90 (updated 08.03.2000)</b>	
0-9	Applicant's or agent's file reference	<b>49617</b>	
2	Applicant	<b>NOKIA NETWORKS OY, et al.</b>	
12	Calculation of prescribed fees	fee amount/multiplier	total amounts (FIM)
12-1	Transmittal fee	T	⇒ 800
12-2	Search fee	S	⇒ 5 618
12-3	International fee Basic fee (first 30 sheets)	b1	2 431,8
12-4	Remaining sheets		0
12-5	Additional amount	(X) 53,51	
12-6	Total additional amount	b2	0
12-7	b1 + b2 =	B	2 431,8
12-8	Designation fees Number of designations contained in international application		85
12-9	Number of designation fees payable (maximum 8)		8
12-10	Amount of designation fee	(X) 523,22	
12-11	Total designation fees	D	4 185,76
12-12	PCT-EASY fee reduction	R	-749,16
12-13	Total International fee (B+D-R)	I	⇒ 5 868,4
12-14	Fee for priority document Number of priority documents requested	1	
12-15	Fee per document	(X) 422	
12-16	Total priority document fee	P	⇒ 422
12-17	<b>TOTAL FEES PAYABLE (T+S+I+P)</b>		⇒ 12 708,4
12-19	Mode of payment	<b>cheque</b>	

**VALIDATION LOG AND REMARKS**

13-2-1	Validation messages Request	Green? A translation of the international application into English will have to be prepared under the responsibility of the ISA selected.
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**PCT (ANNEX - FEE CALCULATION SHEET)**

Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

49617

		<b>Green?</b> Please note that the entire request (including the title of invention) must be in English
13-2-6	Validation messages Contents	<b>Green?</b> Reference number for attached copy of general power of attorney not indicated.
13-2-7	Validation messages Fees	<b>Green?</b> Please verify that modified fee amounts are correct.

Original (for **SUBMISSION**) - printed on 31.03.2000 10:00:50 AM

### PCT-EASY INFORMATION SHEET

(For applicant use only, DO NOT submit this sheet with the international application)

#### VALIDATION LOG

	<b>Request</b>
Green?	A translation of the international application into English will have to be prepared under the responsibility of the ISA selected.
Green?	Please note that the entire request (including the title of invention) must be in English
	<b>Contents</b>
Green?	Reference number for attached copy of general power of attorney not indicated.
	<b>Fees</b>
Green?	Please verify that modified fee amounts are correct.

Before submitting the International Application, please carefully verify that:

- the information contained on printed Request form is correct;
- Box IX of the Request form has been signed;
- all elements of the international application as indicated in Box VIII of the Request form have been attached; and,
- the diskette containing the PCT-EASY zip file of the International Application has been enclosed and has been clearly labeled "PCT-EASY", with the applicant's or agent's file reference, and the first applicant's name.

#### ATTENTION

DO NOT modify any indications on the Request form printout. The attached PCT-EASY application has been locked. If an error or an omission is discovered at this time, you must copy the submitted application as a template and make the change or correction in a new application (using the submitted application as a template). You may create such a template by copying the submitted application from the "Stored Forms" folder to the "New PCT Forms" folder. Open the new (.OWO) file created in the "New PCT Forms" folder, correct the errors and proceed with the submission process again.

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:  
IPEA/SE

# PCT

## CHAPTER II

### DEMAND

under Article 31 of the Patent Cooperation Treaty:  
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND
<b>Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION</b>		
International application No. PCT/FI00/00280	International filing date (day/month/year) 30 March 2000 (30.03.00)	Applicant's or agent's file reference 49617/SKU/PKK (Earliest) Priority date (day/month/year) 1 April 1999 (01.04.99)
Title of invention Method and arrangement for changing parallel signals in a digital data transmission		
<b>Box No. II APPLICANT(S)</b>		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  NOKIA NETWORKS OY P.O. Box 300, FIN-00045 NOKIA GROUP, Finland	Telephone No.:	
	Facsimile No.:	
	Teleprinter No.:	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  LAHTI, Harri Hevontie 25 B, FIN-01820 KLAUKKALA, Finland		
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  TORVINEN, Marko Kilonpuistonkatu 3 A 16, FIN-02610 ESPOO, Finland		
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.		

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is  agent  common representative

and  has been appointed earlier and represents the applicant(s) also for international preliminary examination.

is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: (*Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.*)

BERGGREN OY AB  
P.O. Box 16, FIN-00101 HELSINKI, Finland

Telephone No.:

+358 9 693 701

Faximile No.:

+358 9 693 3944

Teleprinter No.:

Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:**\*

1. The applicant wishes the international preliminary examination to start on the basis of:

the international application as originally filed

the description  as originally filed

as amended under Article 34

the claims  as originally filed

as amended under Article 19 (together with any accompanying statement)

as amended under Article 34

the drawings  as originally filed

as amended under Article 34

2.  The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3.  The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (*This check-box may be marked only where the time limit under Article 19 has not yet expired.*)

\* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

**Language for the purposes of international preliminary examination:** English

which is the language in which the international application was filed.

which is the language of a translation furnished for the purposes of international search.

which is the language of publication of the international application.

which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States (*that is, all States which have been designated and which are bound by Chapter II of the PCT*)

excluding the following States which the applicant wishes not to elect:

**Box No. VI CHECK LIST**

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

1. translation of international application	:	sheets
2. amendments under Article 34	:	sheets
3. copy (or, where required, translation) of amendments under Article 19	:	sheets
4. copy (or, where required, translation) of statement under Article 19	:	sheets
5. letter	:	sheets
6. other (specify)	:	sheets

For International Preliminary Examining Authority use only

received	not received
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

1. <input checked="" type="checkbox"/> fee calculation sheet	4. <input type="checkbox"/> statement explaining lack of signature
2. <input type="checkbox"/> separate signed power of attorney	5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form
3. <input type="checkbox"/> copy of general power of attorney, reference number, if any:	6. <input type="checkbox"/> other (specify):

**Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

BERGGREN OY AB

Sirpa Kuisma  
Patent Agent

HELSINKI, Finland 30 October 2000

— For International Preliminary Examining Authority use only —

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3.  The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.  The applicant has been informed accordingly.
4.  The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5.  Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

— For International Bureau use only —

Demand received from IPEA on:

## PCT

## FEE CALCULATION SHEET

## Annex to the Demand for international preliminary examination

International application No.	PCT/FI00/00280	For International Preliminary Examining Authority use only
Applicant's or agent's file reference	49617/SKU/PKK	Date stamp of the IPEA
Applicant NOKIA NETWORKS OY		
<b>Calculation of prescribed fees</b>		
1. Preliminary examination fee .....	SEK 4.200	P
2. Handling fee ( <i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i> ) .....	SEK 1.270	H
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box .....	SEK 5.470	TOTAL
<b>Mode of Payment</b>		
<input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash	
<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps	
<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons	
<input checked="" type="checkbox"/> bank draft	<input type="checkbox"/> other ( <i>specify</i> ): via SWIFT through account 5439-10-013-49	

**Deposit Account Authorization** (*this mode of payment may not be available at all IPEAs*)

The IPEA/ SE  is hereby authorized to charge the total fees indicated above to my deposit account.

(*this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit*) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

Deposit Account Number

Date (day/month/year)

Signature

# PENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Berggren Oy Ab  
P.O. Box 16  
FIN-00101 HELSINKI  
Finland

**PCT**

*Berggren Oy Ab*  
**WRITTEN OPINION**

*23-03-2001*  
(PCT Rule 66)

Applicant's or agent's file reference  
49617/SKU/PKK

Date of mailing  
(day/month/year)

*21-03-2001*

**REPLY DUE**

within 60 days

from the above date of mailing

International application No.  
PCT/FI00/00280

International filing date (day/month/year)  
30.03.2000

Priority date (day/month/year)  
01.04.1999

International Patent Classification (IPC) or both national classification and IPC7  
H 04 L 1/22 // H 04 B 1/74

Applicant

Nokia Networks Oy et al

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:

- I  Basis of the report
- II  Priority
- III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV  Lack of unity of invention
- V  Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI  Certain documents cited
- VII  Certain defects in the international application
- VIII  Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also** For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis. For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is:

01.08.2001

Name and mailing address of the IPEA/SE

Patent- och registreringsverket  
Box 5055  
S-102 42 STOCKHOLM

Faxsimile No. 08-667 72 88

Telex  
17978  
PATOREG-S

Authorized officer

Åsa Hällgren/mj  
Telephone No. 08-782 25 00

## WRITTEN OPINION

International application No.

PCT/FI00/00280

## I. Basis of the opinion

## 1. With regard to the elements of the international application:\*

 the international application as originally filed the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

 the claims:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement) under article 19

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

 the drawings:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

 the sequence listing part of the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

 the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

 contained in the international application in printed form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4.  The amendments have resulted in the cancellation of: the description, pages \_\_\_\_\_ the claims, Nos. \_\_\_\_\_ the drawings, sheet/fig \_\_\_\_\_5.  This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".

## WRITTEN OPINION

International application No.

PCT/FI00/00280

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>2-10</u>	YES
	Claims	<u>1</u>	NO
Inventive step (IS)	Claims		YES
	Claims	<u>1-10</u>	NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims		NO

**2. Citations and explanations**

The claimed invention relates to a method and an arrangement for providing error-free data transmission. The same information is transmitted in parallel paths. At the receiving end the information received from the path introducing the fewest errors is conducted to an output cable.

The international search has resulted in the following relevant documents:

D1: EP0696111 A2

D2: "A New Synchronization Algorithm for Hitless Protection Switching" (Andreas Iselt 1999)

Document D1 refers to a "hitless" path switching apparatus and method.

Document D2 refers to synchronization when performing "hitless" path switching

Claim 1 relates to a method where a "primary" transmission path is selected, a check sum is calculated and added to the data frames to be transmitted, the data is sent over parallel paths, correctable errors in the received data are corrected, an error sum for each transmission path is calculated, and the error sum of the selected transmission path is compared with the error sum of the other paths. When found necessary, the path selected for receiving is changed over to a path with a smaller error sum.

..../....

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

In D1, a "working" path is selected (abstract; column 2, line 39-48), a bit error check method is applied (column 2, line 13-48; column 5, line 16-22; column 12, line 50-56), the data is sent over parallel paths (column 2, line 39-48), a bit error check and error correction is performed (column 2, line 55 - column 3, line 1; column 12, line 48 - column 13, line 1), and when found necessary the path selected for receiving is changed over to a path with a smaller error sum (column 4, line 34 - column 5, line 15). This corresponds to the invention claimed in claim 1. Therefore, what is claimed in claim 1 is considered to lack novelty.

Claim 3 relates to an "indoor" unit comprising a changeover device for receiving and changing a signal on the basis of an error sum obtained from an "outdoor" unit. Document D1 (figure 3) shows the components included in the switching equipment. It is considered to be obvious for a person skilled in the art that these components could be grouped as suggested in claim 3, and be placed wherever and called whatever is found suitable. Therefore, what is claimed in claim 3 is considered to lack an inventive step.

Claim 6 relates to an "outdoor" unit comprising a transmitter, a receiver and means for calculating an error sum and outputting information about said sum. Even though D1 mainly refers to receiving equipment, it is considered to be obvious that the method described in D1 also includes a transmitter comprising all the technical features described in claim 6. Concerning the "outdoor" unit part, refer to the argumentation regarding claim 3 above. What is claimed in claim 6 is considered to lack an inventive step.

Claim 8 refers to an arrangement for changing parallel signals in digital data transmission. The said arrangement comprises changeover devices, "indoor" and "outdoor" units for receiving and checking the data and correcting the errors. According to the argumentation concerning claim 1, 3 and 6, what is claimed in claim 8 is considered to lack an inventive step.

Claim 2 and claim 9 relate to polynome modelling using "a polynome suitable for modelling". Polynome modelling is considered to be well known for a person skilled in the art. Therefore, what is claimed in claims 2 and 9 is considered to lack an inventive step.

..../....

**WRITTEN OPINION**

International application No.

PCT/FI00/00280

**Supplemental Box**

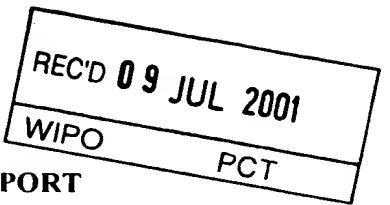
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

Claims 5 and 7 refer to the invention constituting a part of a radio link in a mobile telecommunications system. This is considered to be an obvious possibility for a person skilled in the art. Therefore, what is claimed in claims 5 and 7 is considered to lack an inventive step.

Claims 4 and 10 relates to multiplexers, clock signals, decoding blocks and buffers. All these technical features are considered to be design options, well known to a person skilled in the art, many of which are also shown in the documents mentioned above. Therefore what is claimed in claims 4 and 10 is considered to lack an inventive step.

**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**



(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference 49617/SKU/PKK	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00280	International filing date ( <i>day month year</i> ) 30.03.2000	Priority date ( <i>day month year</i> ) 01.04.1999
International Patent Classification (IPC) or national classification and IPC7 H04L1/22 // H04B 1/74		
Applicant Nokia Networks Oy et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I  Basis of the report
- II  Priority
- III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV  Lack of unity of invention
- V  Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI  Certain documents cited
- VII  Certain defects in the international application
- VIII  Certain observations on the international application

Date of submission of the demand  31.10.2000	Date of completion of this report  20.06.2001
Name and mailing address of the IPEA/SE  Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Åsa Hällgren /OGU Telephone No. 08-782 25 00

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/FI00/00280

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

the international application as originally filed

the description:

pages 1 - 9, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

the claims:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement) under article 19

pages \_\_\_\_\_, filed with the demand

pages 11 - 13, filed with the letter of 21.05.2001

the drawings:

pages 1 - 8, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

the sequence listing part of the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

the language of publication of the international application (under Rule 48.3(b)).

the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

contained in the international application in written form.

filed together with the international application in computer readable form.

furnished subsequently to this Authority in written form.

furnished subsequently to this Authority in computer readable form.

The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4.  The amendments have resulted in the cancellation of:

the description, pages \_\_\_\_\_

the claims, Nos. \_\_\_\_\_

the drawings, sheet/fig \_\_\_\_\_

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/FI00/00280

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-10</u>	YES
	Claims	_____	NO
Inventive step (IS)	Claims	_____	YES
	Claims	<u>1-10</u>	NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims	_____	NO

**2. Citations and explanations (Rule 70.7)**

The claimed invention relates to a method and an arrangement for providing error-free data transmission. The same information is transmitted in parallel paths. At the receiving end the information received from the path introducing the fewest errors is conducted to an output cable.

The international search has resulted in the following relevant documents:

D1: EP0696111 A2

D2: "A New Synchronization Algorithm for Hitless Protection Switching" (Andreas Iselt 1999)

Document D1 refers to a "hitless" path switching apparatus and method.

Document D2 refers to synchronization when performing "hitless" path switching

Claim 1 relates to a method where a "primary" transmission path is selected, a check sum is calculated and added to the data frames to be transmitted, the data is sent over parallel paths, correctable errors in the received data are corrected, an error sum for each transmission path is calculated and the error sum of the selected transmission path is compared with the error sum of the other paths. When found necessary, the path selected for receiving is changed over to a path with a smaller error sum. In D1, a "working" path is selected (abstract; column 2, line 39-48), a bit error check method is applied (column 2, line 13-48; column 5, line 16-22; column 12, line 50-56), the data is sent over parallel paths (column 2, line 39-48), a bit error check and error correction is performed (column 2, line 55 - column 3, line 1; column 12, line 48 - column 13, line 1) and when found necessary, the

.../...

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V.

1 (2)

path selected for receiving is changed over to a path with a smaller error sum (column 4, line 34 - column 5, line 15).

The transmission in the examples in D1 and D2 is performed over a wire, and is not wireless as in the new claim 1 of 2001-05-21. However, to change a channel in a cable for a radio channel is not in itself considered to involve an inventive step - the inventive concept is the same.

In claim 1 of 2001-05-21, a clock signal is also mentioned, which is changed over after waiting for a sufficiently accurate cophasal clock signal. This clock signal is considered to be a design detail in context of the invention. It is also considered to be a mere design option for a person skilled in the art.

Therefore, what is claimed in claim 1 is considered to lack an inventive step.

Claim 3 relates to an "indoor" unit comprising a changeover device for receiving and changing a signal on the basis of an error sum obtained from an "outdoor" unit. Document D1 (figure 3) shows the components included in the switching equipment. It is considered to be obvious for a person skilled in the art that these components could be grouped as suggested in claim 3, and be placed wherever and called whatever is found suitable. This, in combination with the argumentation concerning claim 1 regarding the radio link and clock signal aspect, concludes that what is claimed in claim 3 is considered to lack an inventive step.

Claim 6 relates to an "outdoor" unit comprising a transmitter, a receiver and means for calculating an error sum and outputting information about said sum. Even though D1 mainly refers to receiving equipment, it is considered to be obvious that the method described in D1 also includes a transmitter comprising all the technical features described in claim 6. Concerning the "outdoor" unit part, refer to the argumentation regarding claim 3 above.

The transmission in the examples in D1 is performed over a wire, and is not wireless as in the new claim 6 of 2001-05-21. However, to change a channel in a cable for a radio channel is not in itself considered to involve an inventive step - the inventive concept is the same.

Therefore, what is claimed in claim 6 is considered to lack an inventive step.

Claim 8 refers to an arrangement for changing parallel signals in digital data transmission. The said arrangement comprises  
.../...

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V.

2 (2)

changeover devices, "indoor" and "outdoor" units for receiving and checking the data and correcting the errors. According to the argumentation concerning claims 1, 3 and 6, what is claimed in claim 8 is considered to lack an inventive step.

Claim 2 and claim 9 relate to polynome modelling using "a polynome suitable for modelling". Polynome modelling is considered to be well known to a person skilled in the art. Therefore, what is claimed in claims 2 and 9 is considered to lack an inventive step.

Claims 5 and 7 refer to the invention constituting a part of a radio link in a mobile telecommunications system. It is already stated in the independent claims 3 and 6 that the context of the invention is a radio link. Therefore, claims 5 and 7 add no new information and can be removed. Consequently, what is claimed in claims 5 and 7 is considered to lack an inventive step.

Claims 4 and 10 relate to multiplexers, clock signals, decoding blocks and buffers. All these technical features are considered to be design options, well known to a person skilled in the art, many of which are also outlined in the aforementioned documents. Therefore what is claimed in claims 4 and 10 is considered to lack an inventive step

According to the argumentation above, what is claimed in claims 1-10 is found to be novel. The invention according to claims 1-10 is not considered to involve an inventive step. All that is claimed in claims 1-10 is considered to have industrial applicability.

~~REPLACED BY  
ART 34 AMDT~~

11

## Claims

1. A method for changing parallel signals in a digital data transmission, in which method the data flow to be transmitted is divided into several transmissions, characterised in that

5 - there is selected a primary transmission path (21),  
- there is calculated a check sum for the data flow of the length of the processed section, and said check sum is added to the processed section of the data flow (22) in order to form a data frame to be transmitted,  
- in the transmission paths, there is carried out the transmission of the data frame  
10 (23),  
- correctable errors in the received data frames are corrected, and an error sum for each transmission paths is calculated,  
- the error sum of the selected transmission path is compared (25) with the other paths and when necessary, the transmission path selected as the one to be received  
15 is changed over (26) to a path with a smaller error sum, and  
- the information in the data flow of the processed section of the selected transmission path is conducted (27) to the output cable.

2. A method according to claim 1, characterised in that the check sum is calculated by multiplying the data flow by a polynome suitable for modelling.

20 3. An indoor unit (31, 37) for digital data transmission and for selecting the data flow for parallel signals in digital data transmission, characterised in that the indoor unit comprises at least a changeover device (38) for receiving and changing a propagation assured signal on the basis of an error sum obtained from an outdoor unit.

25 4. An indoor unit according to claim 3, characterised in that the changeover devices comprise  
- a multiplexer (51) whereto the clock signals of the signal pairs to be received are conducted, and whereby the clock signal to be received is selected,

- data frame decoding blocks (52, 53) whereto both the clock signals and the data signals are conducted, and where said signals are formed into control signals and data signals decoded from the frames,

5 - elastic buffer and control blocks (54, 55) whereto the control signals and data signals decoded from the frames are conducted, and whereto the selected clock signal to be received is conducted in order to synchronise the data,

- a data signal multiplexer (56), whereto the data signals are conducted from the elastic buffer and control blocks (54, 55), and

10 - a decoding block (57) whereto a data signal is conducted from the data signal multiplexer, and whereby the data signal multiplexer (56) is controlled.

5. An indoor unit according to claim 3 or 4, characterised in that the indoor unit (31, 37) constitutes part of a radio link in a mobile telecommunications system.

15 6. An outdoor unit (33, 36) for digital data transmission and for selecting the data flow for parallel signals in digital data transmission, characterised in that said outdoor unit comprises at least a transmitter for transmitting the signal to be changed and respectively a receiver for receiving said signal, and means (33A, 36A) for calculating the error sum of the received signal and further for outputting the information indicating said error sum.

20 7. An outdoor unit according to claim 6, characterised in that the outdoor unit (33, 36) forms part of a radio link in a mobile telecommunications system.

25 8. An arrangement for changing parallel signals in digital data transmission, said arrangement comprising a first indoor unit (31) for dividing the data flow, antennas (34, 35, 40, 41) for transmitting and receiving parallel clock signals and a second indoor unit (37) for selecting the data flow, characterised in that said arrangement also comprises

- a first changeover device (32) in the first indoor unit (31) and a second changeover device (38) in the second indoor unit (37) for receiving the propagation assured data, and

30 - a first (33) and second (36) outdoor unit provided with means (33A, 36A) for processing by an algorithm that models the data to be transmitted and respectively checks the data to be received and corrects errors.

9. An arrangement according to claim 8, characterised in that the algorithm modelling the data is a polynome.

10. An arrangement according to claim 8, characterised in that the changeover devices comprise

- 5 - a multiplexer (51) whereto the clock signals of the signal pairs to be received are conducted and whereby the clock signal to be received is selected,
- data frame decoding blocks (52, 53), whereto both the clock signals and the data signals are conducted, and where said signals are formed into control signals and data signals decoded from the frames,
- 10 - elastic buffer and control blocks (54, 55), whereto the control signals and data signals decoded from the frames are conducted, and whereto also is conducted the selected clock signal to be received, in order to synchronise the data,
- a data signal multiplexer (56) whereto the data signals are conducted from the elastic buffer and control blocks (54, 55), and
- 15 - a decoding block (57) whereto a data signal is conducted from the data signal multiplexer and whereby the data signal multiplexer (56) is controlled.

# RECORD CORP

1/4

## PCT REQUEST

Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

49617

0-1	For receiving Office use only International Application No.	<b>PCT/FI 00 / 00280</b>
0-2	International Filing Date	<b>31 MAR 2000 (31.03.00)</b>
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	<b>PCT-EASY Version 2.90 (updated 08.03.2000)</b>
0-5	<b>Petition</b> The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	<b>Receiving Office (specified by the applicant)</b>	<b>National Board of Patents and Registration (Finland) (RO/FI)</b>
0-7	<b>Applicant's or agent's file reference</b>	<b>49617</b>
I	<b>Title of invention</b>	<b>METHOD AND ARRANGEMENT FOR CHANGING PARALLEL SIGNALS IN A DIGITAL DATA TRANSMISSION</b>
II	<b>Applicant</b> This person is: II-1 Applicant for II-2 Name II-3 Address: II-4 State of nationality II-5 State of residence II-6 Telephone No. II-7 Facsimile No.	applicant only all designated States except US NOKIA NETWORKS OY P.O. Box 300 FIN-00045 Nokia Group Finland FI FI +358-9-51121 +358-9-51168080
III-1	<b>Applicant and/or inventor</b> This person is: III-1-1 Applicant for III-1-2 Name (LAST, First) III-1-3 Address: III-1-4 State of nationality III-1-5 State of residence	applicant and inventor US only LAHTI, Harri Hevontie 25 B FIN-01820 Klaaukkala Finland FI FI

**PCT REQUEST**

Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

III-2	<b>Applicant and/or inventor</b>	
III-2-1	This person is:	<b>applicant and inventor</b>
III-2-2	Applicant for	<b>US only</b>
III-2-4	Name (LAST, First)	<b>TORVINEN, Marko</b>
III-2-5	Address:	<b>Kilonpuistonkatu 3 A 16 FIN-02610 Espoo Finland</b>
III-2-6	State of nationality	<b>FI</b>
III-2-7	State of residence	<b>FI</b>
IV-1	<b>Agent or common representative; or address for correspondence</b>  The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: Name	<b>agent</b>
IV-1-1	Name	<b>BERGGREN OY AB</b>
IV-1-2	Address:	<b>P.O. Box 16 FIN-00101 Helsinki Finland</b>
IV-1-3	Telephone No.	<b>+358-9-693701</b>
IV-1-4	Facsimile No.	<b>+358-9-6933944</b>
IV-1-5	e-mail	<b>email.box@berggren.fi</b>
V	<b>Designation of States</b>	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<b>AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</b> <b>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</b> <b>EP: AT BE CH&amp;LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</b> <b>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</b>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<b>AE AG AL AM AT AU AZ BA BB BG BR BY CA CH&amp;LI CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</b>

**PCT REQUEST**

49617

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V-5	<b>Precautionary Designation Statement</b> In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	<b>Exclusion(s) from precautionary designations</b>	<b>NONE</b>	
VI-1	<b>Priority claim of earlier national application</b>		
VI-1-1	Filing date	<b>01 April 1999 (01.04.1999)</b>	
VI-1-2	Number	<b>990739</b>	
VI-1-3	Country	<b>FI</b>	
VI-2	<b>Priority document request</b> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	<b>VI-1</b>	
VII-1	<b>International Searching Authority Chosen</b>	<b>Swedish Patent Office (ISA/SE)</b>	
VIII	<b>Check list</b>	number of sheets	electronic file(s) attached
VIII-1	Request	<b>4</b>	-
VIII-2	Description	<b>9</b>	-
VIII-3	Claims	<b>3</b>	-
VIII-4	Abstract	<b>1</b>	<b>49617.txt</b>
VIII-5	Drawings	<b>8</b>	-
VIII-7	<b>TOTAL</b>	<b>25</b>	
VIII-8	<b>Accompanying items</b>	paper document(s) attached	electronic file(s) attached
VIII-9	Fee calculation sheet	✓	-
VIII-10	Separate signed power of attorney	✓	-
VIII-16	Copy of general power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	<b>diskette</b>
VIII-18	<b>Figure of the drawings which should accompany the abstract</b>	<b>3</b>	
VIII-19	<b>Language of filing of the international application</b>	<b>Finnish</b>	
IX-1	<b>Signature of applicant or agent</b>		
IX-1-1	Name	<b>BERGGREN OY AB</b>	
IX-1-2	Name of signatory	<b>Joni Mikkola</b>	
IX-1-3	Capacity	<b>Patent Agent</b>	

**PCT REQUEST**

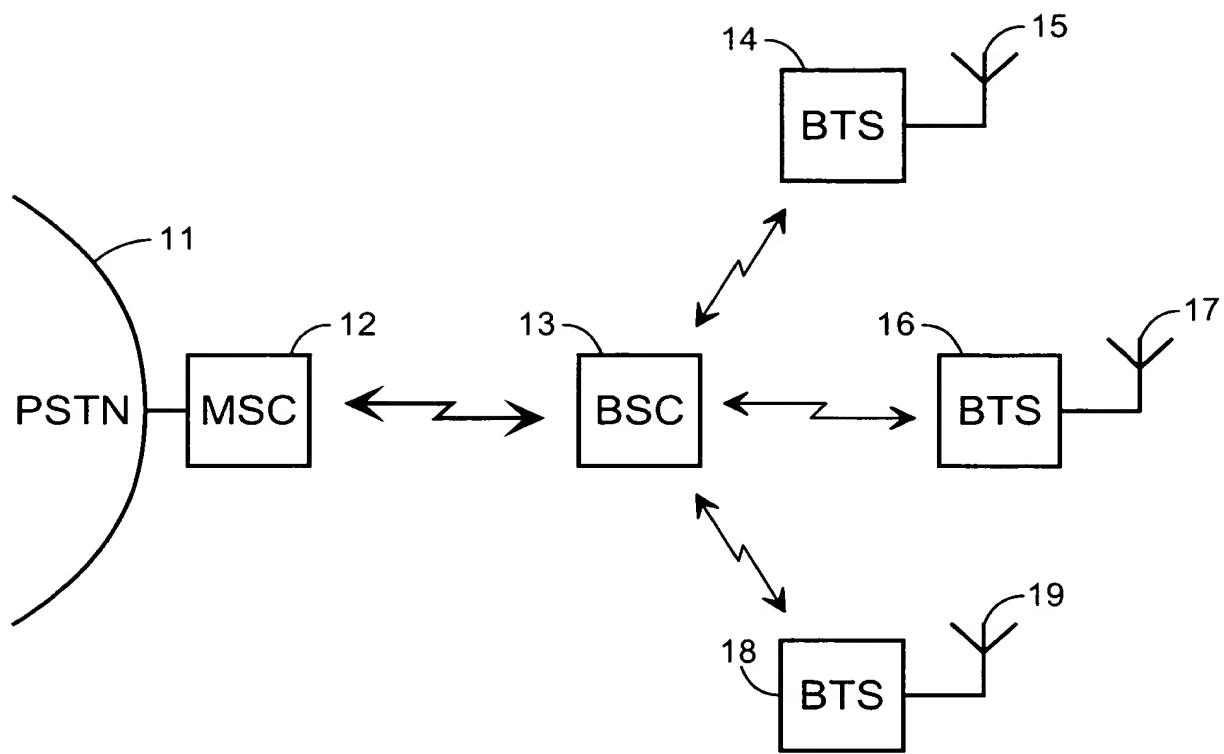
Original (for SUBMISSION) - printed on 31.03.2000 10:00:50 AM

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10-1	Date of actual receipt of the purported international application	31 MAR 2000 ( 31 -03- 2000 )
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

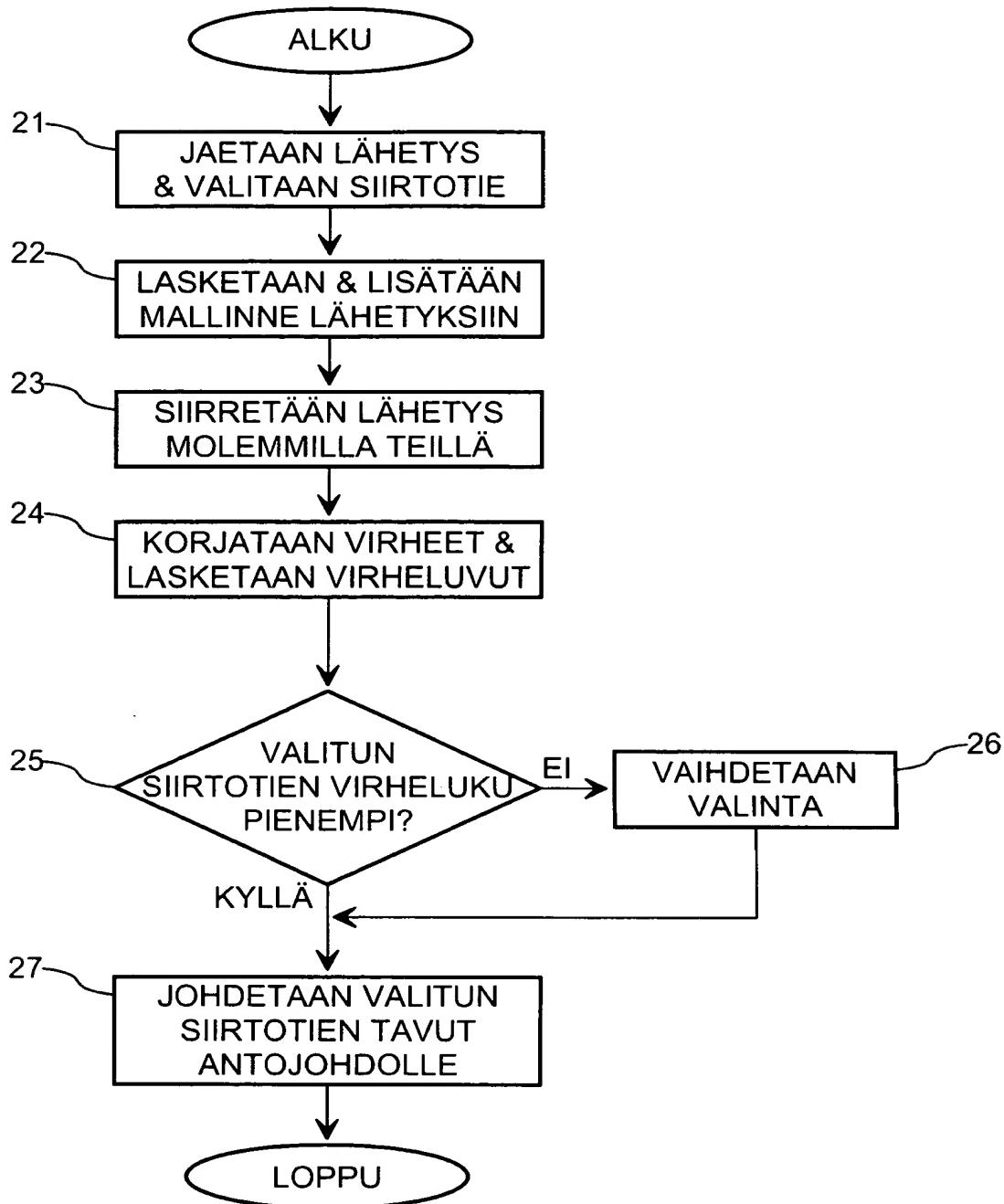
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11-1	Date of receipt of the record copy by the International Bureau	01 MAY 2000 ( 01.05.00 )
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KUVIO 1

2/8

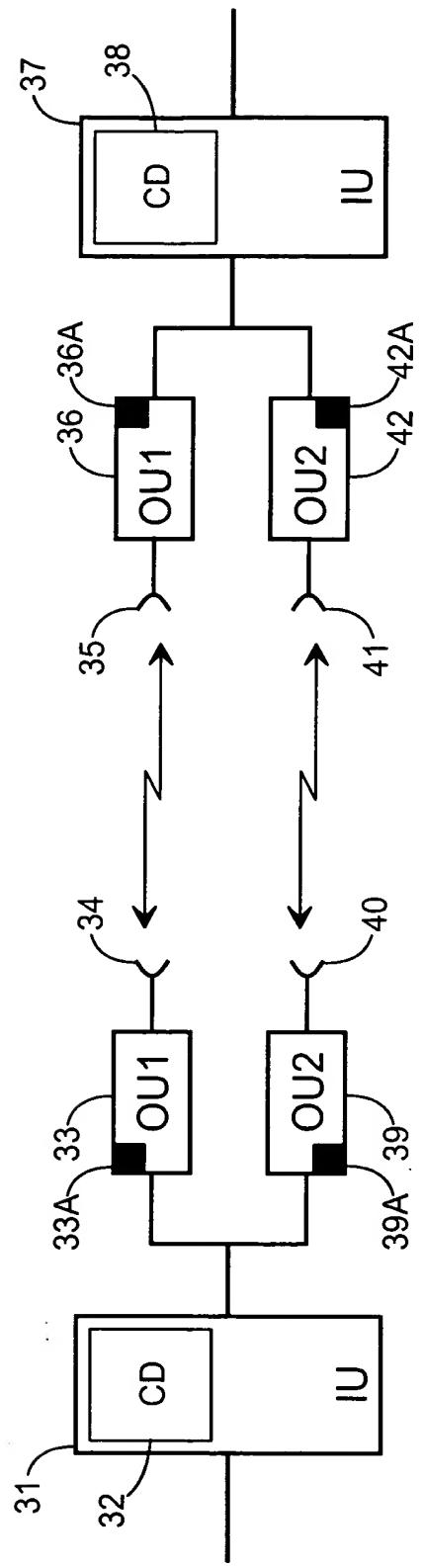


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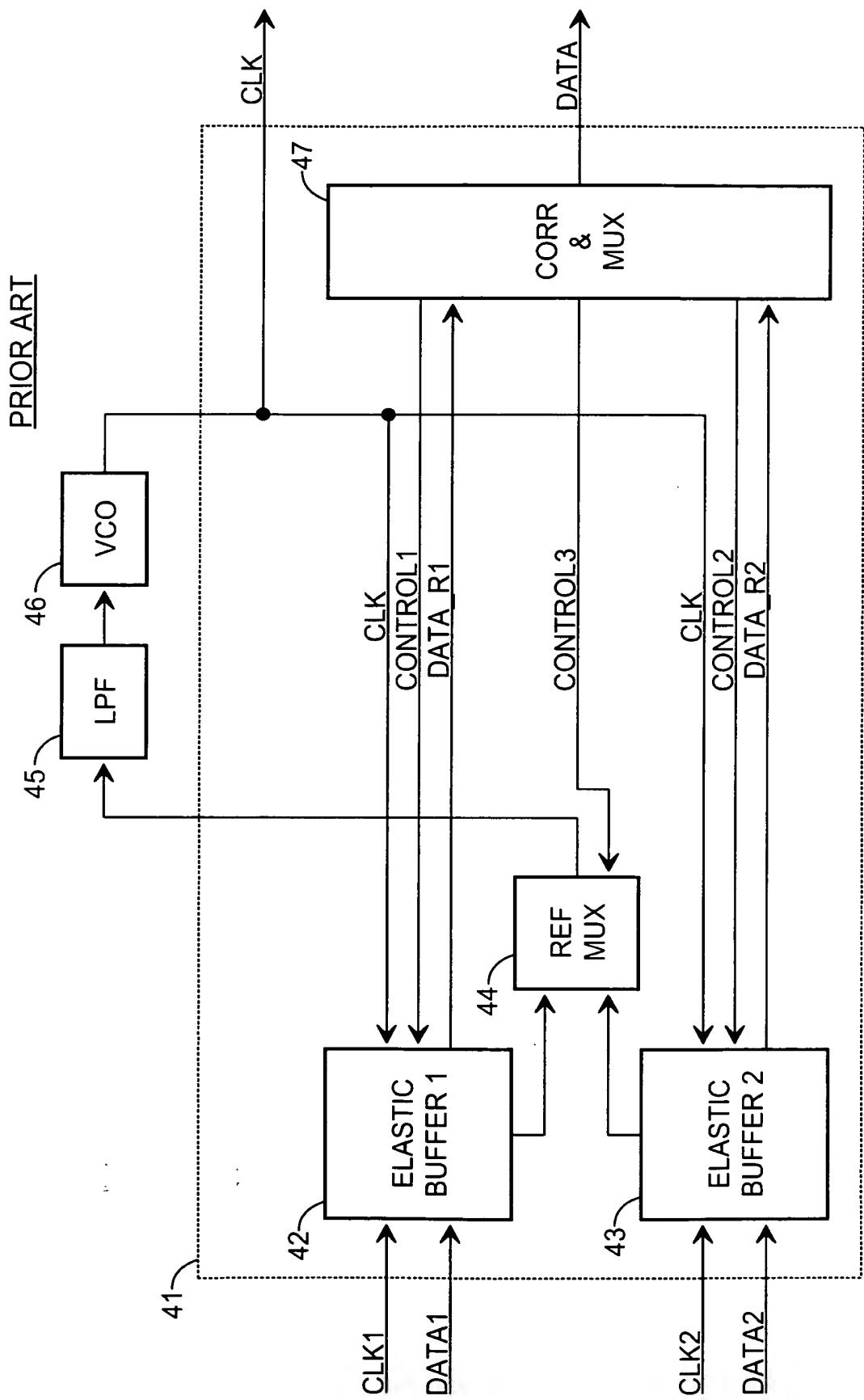
91

A	B	C	B			C	B	C	B	C	B	CD
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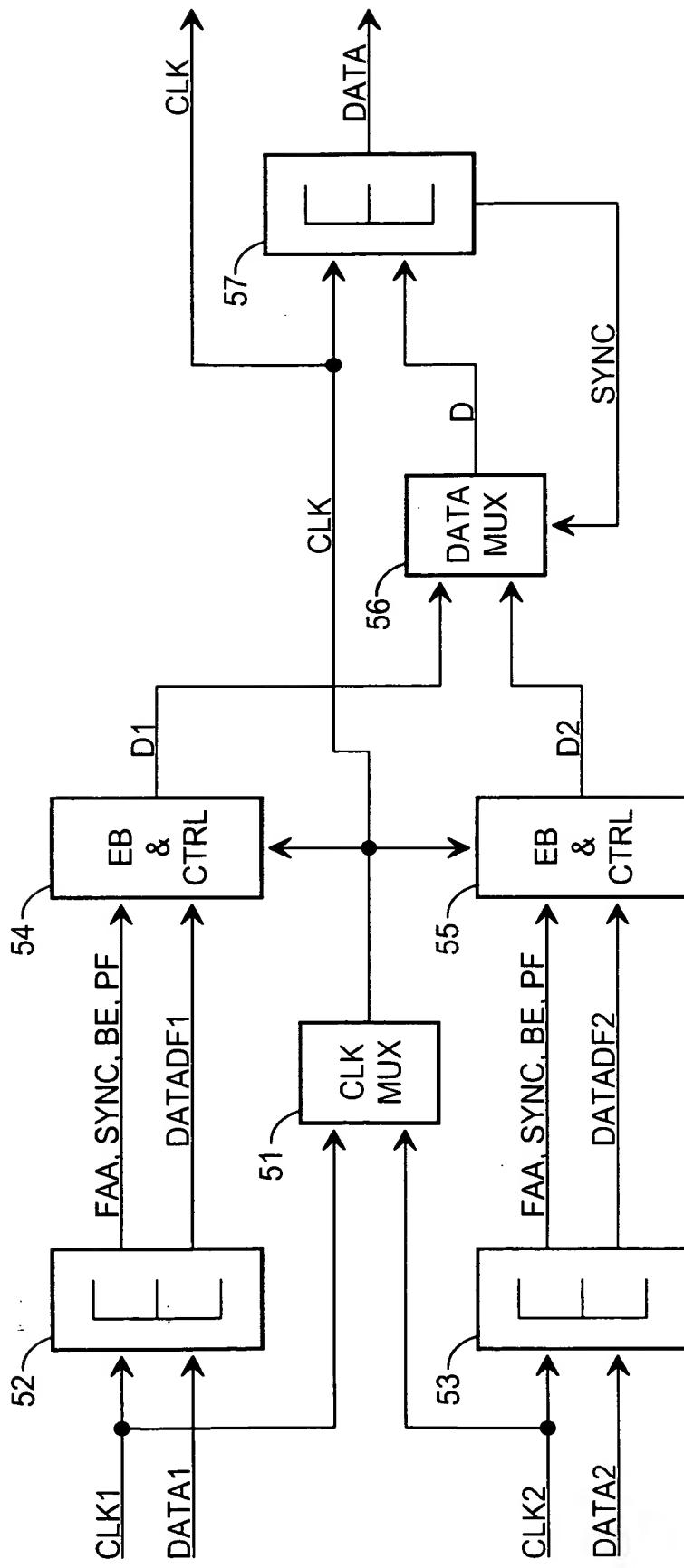
KUVIO 9



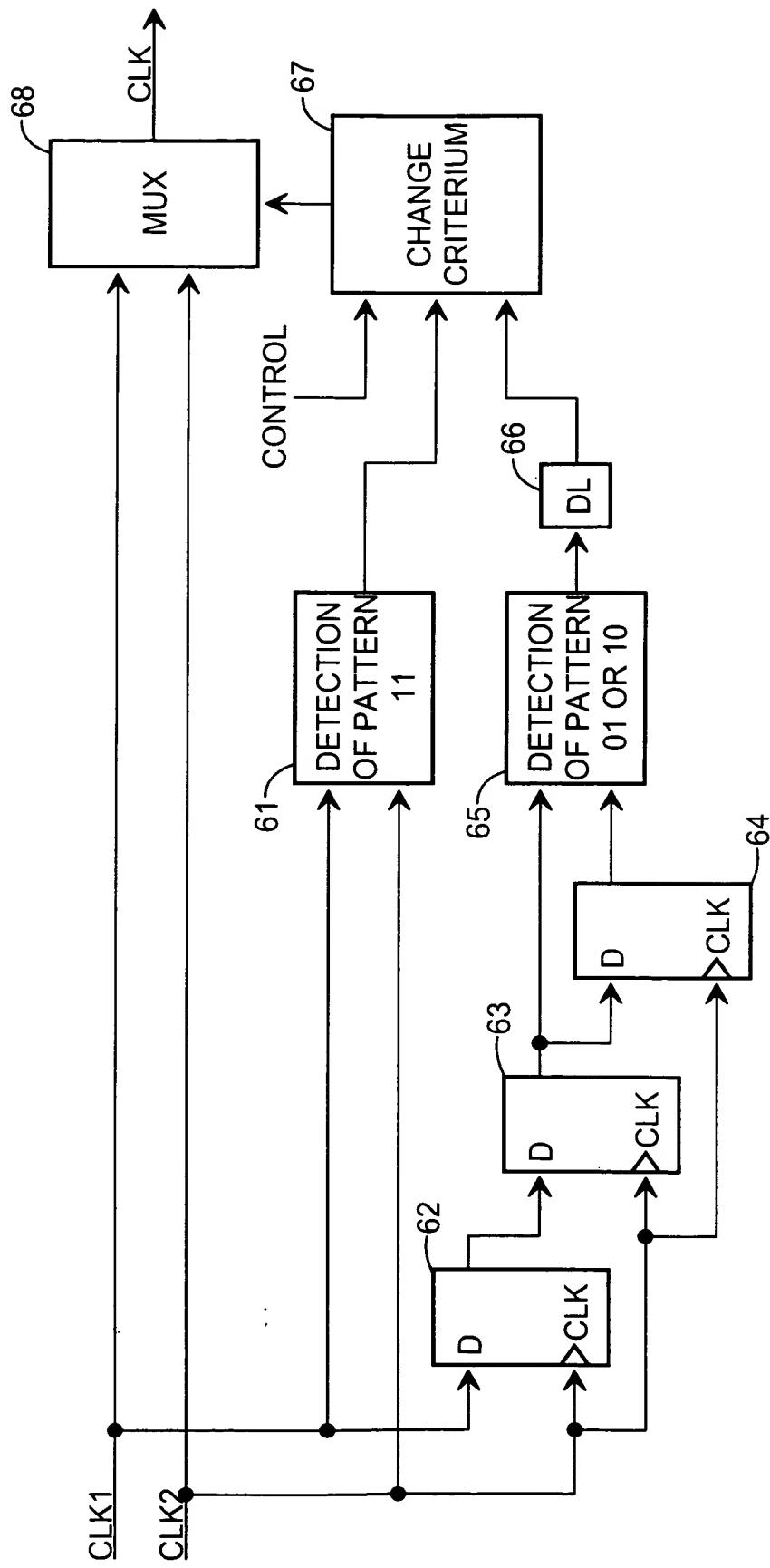
KUVIO 3



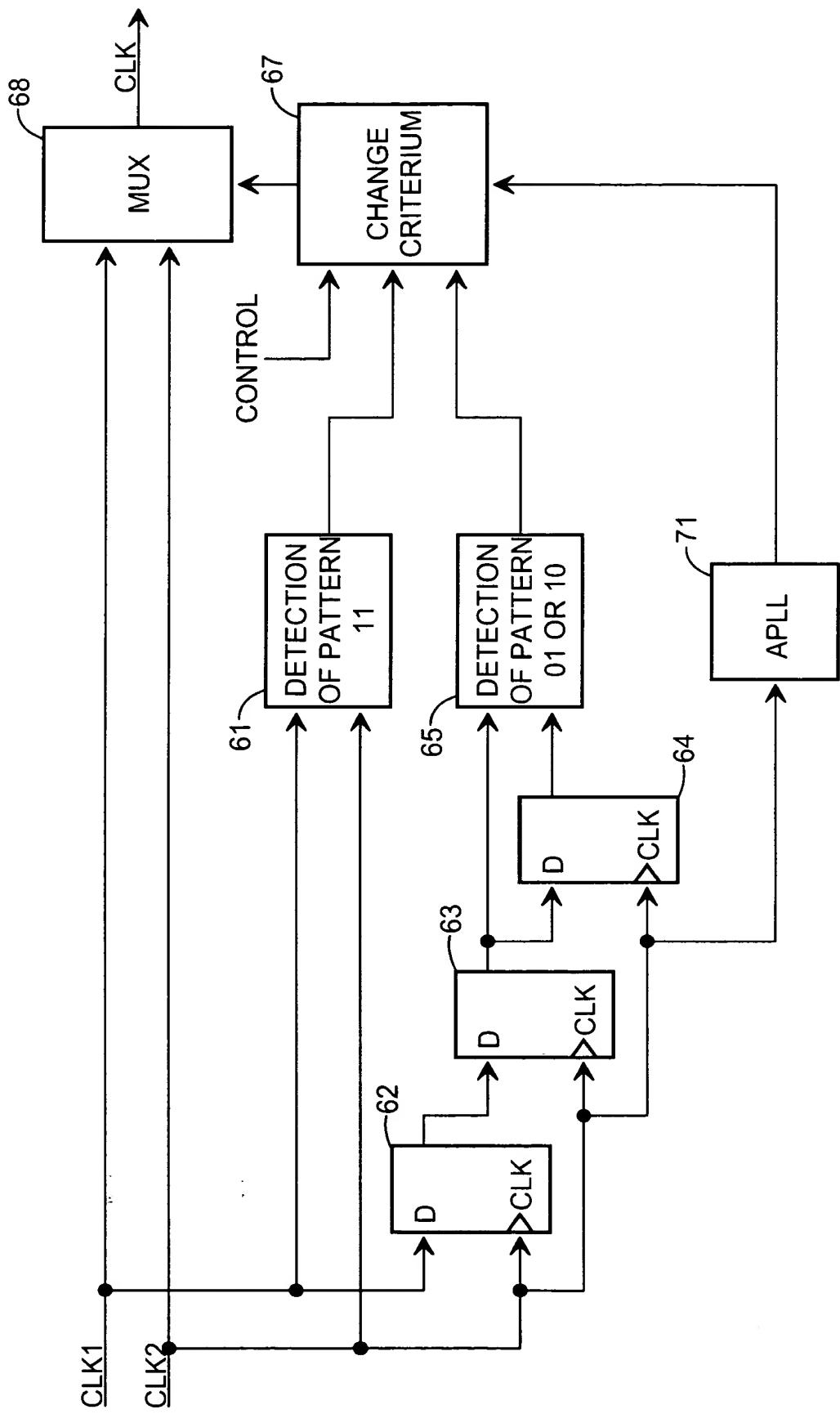
KUVIO 4



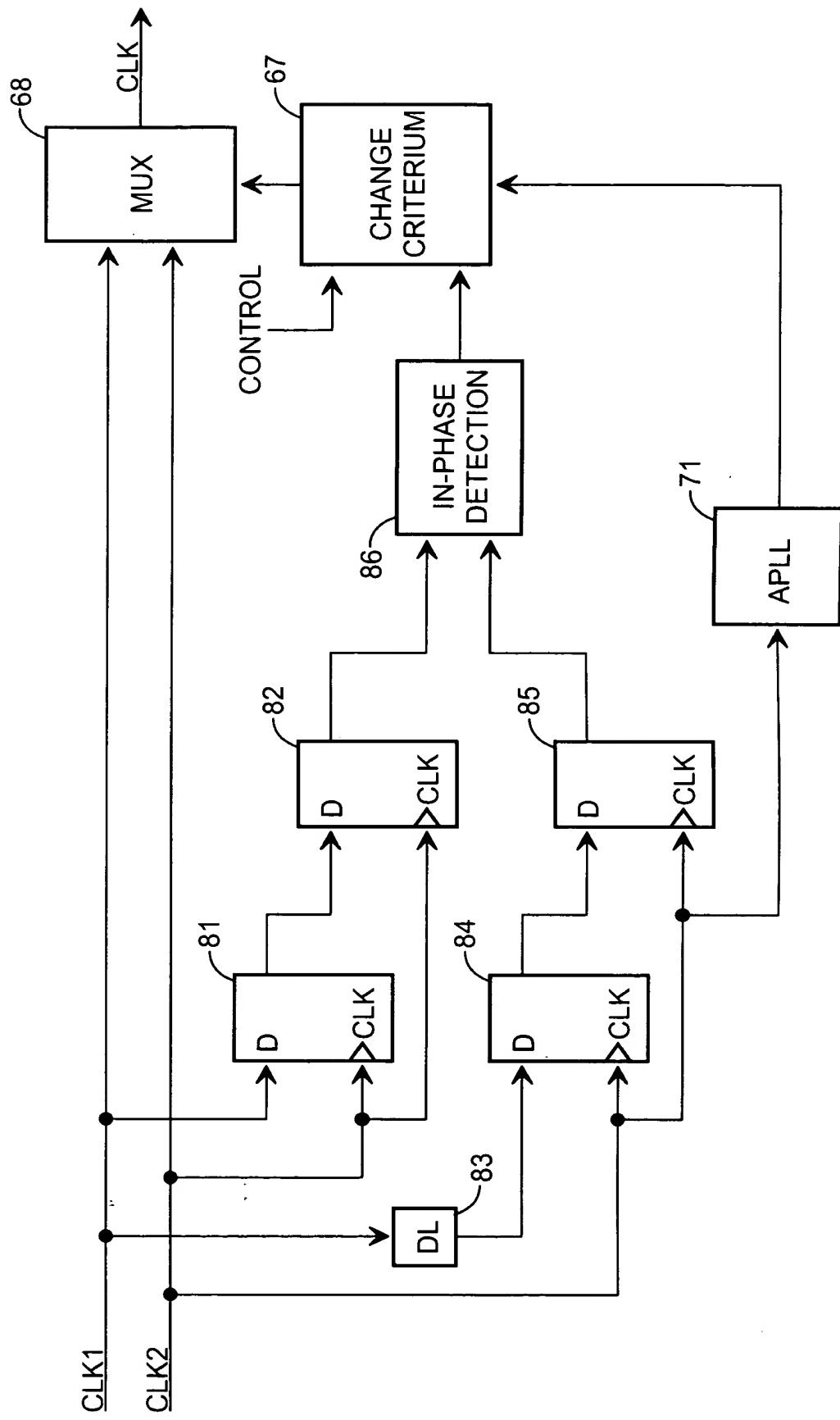
KUVIO 5



KUVIO 6



KUVIO 7



KUVIO 8

**Menetelmä ja järjestely digitaalisen tiedonsiirron rinnakkaisten signaalien vaihtamiseksi**

Keksinnön kohteena on menetelmä ja järjestely digitaalisen tiedonsiirron etenemisvarmennuksen rinnakkaisten signaalien vaihtamiseksi erityisesti radiolinkkien etenemisvarmennuksen toteuttamista varten. Signaalit käsitteväät kello- ja datasaaleja. Keksintö soveltuu myös muihin siirtoyhteyksiin, esimerkiksi optista siirtotietä käyttäviin yhteyksiin.

Tunnetaan digitaalisen radiolinkin tiedonsiirron laatuvaatimukset, joita asettaa mm. kansainvälinen tietoliikenneliitto (ITU, International Telecommunication Union). Laatuvaatimukset koskevat siirron varmuutta ja häiriöttömyyttä. Erityisesti on kyse käytettävyydestä, virhesuhteesta ja vaihekohinasta. Näiden kriteerien täyttämiseen vaikuttavat laitteiden vikaantumiset, säätila ja signaalin kulkutien muuttuminen. Vaatimusten täyttämiseksi tarvitaan radiolinkin laite- ja etenemisvarmennus. Laitevarmennuksella saadaan varmempi käytettävyys ja etenemisvarmennuksella saadaan sekä pienempi virhesuhde, pienempi vaihekohina että parempi käytettävyys.

Kuviossa 1 esitetään lohkokaaviona etenemisvarmennuksen yksi käyttökohde. Yleinen kytkentäinen puhelinverkko (PSTN, Public Switched Telephone Network) 11 on kytketty johdoin matkaviestinliikenteen kytkentäkeskukseen (MSC, Mobile Switching Centre) 12. Koska kytkentäkeskuksen 12 ja tukiasemien ohjaimen (BSC, Base Station Controller) 13 välinen radiolinkki on varmuudeltaan erittäin tärkeä, se yleensä varmennetaan. Ohjain 13 kytketään edelleen radioyhteyksillä, jotka ovat myös varmennettavissa, tukiasemiin (BTS, Base Telecommunication Station) 14, 16, 18 ja näiden antenneihiin 15, 17, 19.

25 Radiolinkkien etenemisvarmennus toteutetaan yhdellä tai useammalla rinnakkaisella radioyhteydellä. Tällöin pääasiallisen radioyhteyden rinnalle rakennetaan yksi tai useampi toinen saman informaation kuljettava varmentava siirtotie. Siirtotiet ovat mieluiten erilaiset, jotta mahdolliset maastosta ja/tai sään vaihteluista aiheutuvat häiriöt eivät kytkeytyisi molempien samanaikaisesti. Siirtoteistä valitaan radiolinkin vastaanottavalla asemalla signaalitaan parempi olosuhteiden mukaan. Valintakriteerinä käytetään yleensä signaalin voimakkuutta, mutta myös vastaanotetun tiedon pariteetin oikeellisuutta. Siirtotien vaihto suoritetaan erityisellä vaihtolaitteella mahdollisimman virheettömästi tasaamalla signaalien etenemisestä eri siirtoteillä aiheutuva sekä staattinen että dynaaminen vaihe-ero.

Tunnetaan myös yleinen digitaalisen tiedonsiirron varmentaminen etenemissuuntaisella virheenkorjauksella (FEC, Forward Error Correction). Tietovirtaan lisätään virheenkorjauksen mahdollistavaa lisäinformaatiota.

Eräs ongelma tunnetuissa laitteissa on, että vaihdettaessa vastaanotettava siirtotie 5 signaalin voimakkuuden vähenemisen perusteella ei huomioida monitie-etenemistä tai virhepurskeita, jotka voivat aiheuttaa virheitä signaaliin.

Edelleen ongelmana tunnetuissa laitteissa on, että vastaanotettavan siirtotien vaihtoa ei kyetä aina suorittamaan ennen tiedon virheellistä vastaanottoa, sillä kun virhe havaitaan, se on jo läpäissyt linkin.

10 Edelleen ongelmana tunnetuissa virheenkorjausmenetelmissä on, että virheitä ei aina kyetä korjaamaan täysin.

Keksinnön tarkoituksena on esittää parempi varmennetun tiedonsiirtolinkin rinnakkaisen siirtoyhteyksien vaihtomenetelmä ja -laite. Keksinnön mukaisella tavalla vastaanotettava siirtotie vaihdetaan ennen virheiden läpäisyä ja linkin tiedonvälitys 15 säilyy virheettömänä, mikäli edes yksi siirtoteistä välittää tiedon virheettömänä, vaikka toisessa aiheutuu virheitä. Linkin virheettömyys säilyy myös silloin, kun virheetön tiedonsiirtotie muuttuu nopeasti virheelliseksi ja virheellinen tiedonsiirtotie virheettömäksi.

20 Tämä toteutetaan laskemalla siirtoteille yhteisen sisäyksikön (IU, Indoor Unit) jälleen rinnakkaisissa ulkoyksiköissä (OU, Outdoor Unit) virheenkorjauksen mahdolistava korjattavan tarkasteluvälin tiedon tarkistussumma, tarkastamalla vastaanottavissa ulkoyksiköissä tiedon virheettömyys tai korjaamalla korjauskelpoiset virheet sekä valitsemalla vastaanottavassa sisäyksikössä ulkoyksiköstä annetun virheettömyyttä esittävän hyväyslувun perusteella virheettömämpi siirtotie, mikäli käytettävä 25 yhteys aiheuttaa virheitä.

Keksintö koskee menetelmää digitaalisen tiedonsiirron rinnakkaisen signaalien vaihtamiseksi, jossa menetelmässä siirrettävä tietovirta jaetaan useaan lähetykseen. Keksinnön mukaisesti

- valitaan ensisijainen siirtotie,

30 - siirtoteillä lasketaan käsittelyosan pituisen tietovirran tarkistussumma ja lisätään tarkistussumma tietovirran käsittelyosan yhteyteen siirrettävän tietokehyksen muodostamiseksi,

- siirtoteillä suoritetaan tietokehyksen siirto,
- vastaanotettujen tietokehysten korjauskelpoiset virheet korjataan ja lasketaan virheluku siirtoteillä,
- siirtoteille yhteisenä toiminteenä verrataan valitun siirtotien virhelukua toisiin ja tarvittaessa vaihdetaan vastaanottavaksi valittu siirtotie virheluvultaan pienempään, ja
- johdetaan valittuna olevan siirtotien tietovuon käsitellysan tieto antojohdolle.

Keksintö koskee sisäyksikköä, joka on digitaalista tiedonsiirtoa ja digitaalisen tiedonsiirron rinnakkaisten signaalien tietovuon valintaa varten. Keksinnön mukaisesti sisäyksikköön kuuluu vaihtolaite signaalin vastaanottamiseksi ja vaihtamiseksi ulko-  
10 yksiköltä saatavan virheluvun perusteella.

Keksintö koskee ulkoyksikköä, joka on digitaalista tiedonsiirtoa ja digitaalisen tiedonsiirron rinnakkaisten signaalien tietovuon valintaa varten. Keksinnön mukaisesti ulko-  
15 yksikköön kuuluu siirrettävän signaalin lähetin sekä vastaavasti signaalin vastaanottava vastaanotin ja vastaanotetun signaalin virheluvun laskenta sekä edelleen virheluvun osoittavan tiedon anto sisäyksikölle.

Keksintö koskee myös järjestelyä digitaalisen tiedonsiirron rinnakkaisten signaalien vaihtamiseksi, johon järjestelyyn kuuluu ensimmäinen sisäyksikkö, antennit molempien rinnakkaisten signaalien lähetämistä ja vastaanottamista varten ja toinen sisäyksikkö. Keksinnön mukaisesti siihen lisäksi kuuluu  
20

- ensimmäinen vaihtolaite ensimmäisessä sisäyksikössä ja toinen vaihtolaite toisessa sisäyksikössä etenemisvarmennetun tiedon vastaanottoa varten, ja
- molemmilla siirtoteillä ensimmäinen ja toinen ulkoyksikkö lähetettävän tiedon mallintavalla sekä vastaavasti vastaanottavan tiedon tarkastavalla ja virheenk-  
25 jaavalla algoritmilla käsittevä varten.

Keksinnön mukaisesti siirtotien vaihto suoritetaan aina kun toiselta tieltä vastaanote-  
taan parempi tietokehys. Vaihto suoritetaan täten kehyskohtaisesti vertaamalla kah-  
den tai useaman rinnakkaisen tietovuon virheiden määrää.

Vaihtolaite on toteutettavissa täysin sovelluskohtaisella integroidulla piirillä (ASIC,  
30 Application Specific Integrated Circuit).

Keksinnön edullisia suoritusmuotoja on esitetty epäitsenäisissä patenttivaatimuksissa.

Seuraavassa keksintöä selostetaan yksityiskohtaisesti viittaamalla oheiseen piirustukseen, jossa

- 5 kuvio 1 esittää lohkokaaviota eräästä etenemisvarmennuksen käyttöympäristöstä,
- kuvio 2 esittää vuokaaviota eräästä keksinnön mukaisesta menetelmästä,
- kuvio 3 esittää lohkokaaviota eräästä keksinnön mukaisesta järjestelystä,
- kuvio 4 esittää lohkokaaviota eräästä tunnetusta signaalin vaihtolaitteesta,
- 10 kuvio 5 esittää lohkokaaviota eräästä vaihtolaitteesta, jossa käytetään keksinnön mukaista kellosignaalin kanavointilaitetta,
- kuvio 6 esittää lohkokaaviota eräästä keksinnön mukaisesta kellosignaalin kanavointilaitteesta,
- kuvio 7 esittää lohkokaaviota eräästä toisesta keksinnön mukaisen järjestelyn kellosignaalin kanavointilaitteesta,
- 15 kuvio 8 esittää lohkokaaviota eräästä kolmannesta keksinnön mukaisen järjestelyn kellosignaalin kanavointilaitteesta, ja
- kuvio 9 esittää eräästä tietokehystä.

Kuviota 1 on käsitelty edellä tunnetun tekniikan osiossa.

Kuviossa 2 esitetään vuokaaviossa erään keksinnön mukaisen menetelmän toiminta-vaiheita. Siirrettävä tietovirta jaetaan kahteen lähetykseen ja valitaan ensisijainen siirtotie eli oletustie 21. Molemmilla siirtoteillä lasketaan käsittelyosan pituisen tietovirran tarkistussumma esimerkiksi kertomalla tietovirta mallintamiseen sopivalla polynomilla ja lisätään tarkistussumma tietovirran käsittelyosan yhteyteen 22. Alku-peräisen tietovirran käsittelyosa ja tarkistussumma yhdessä muodostavat siirrettävän 25 tietokehyksen. Käsittelyosa määritää virheenkorjausalgoritmilla käsiteltävän tietovuon yksittäisen osan, kuten kehyksen. Tästä osasta lasketaan edullisimmin tarkistusluku, joka mahdollistaa virheiden havaitsemisen ja pienien virheiden korjauksen vastaanotettaessa tietoa. Virheet havaitaan laskemalla vastaanotetusta tietovuon osasta samalla tavalla toinen tarkistusluku ja vertaamalla lukuja keskenään. Sopivia

polynomeja ovat ainakin muutamat jakavat polynomit, joiden jakojäännöstä käytetään tähän.

Molemmilla siirtoteillä suoritetaan tietokehyksen siirto esimerkiksi radioyhteydellä 23. Siirtoon radioyhteydellä kuuluu signaalin modulointi, lähetys, vastaanotto ja demodulointi sekä suodatus.

Vastaanotettujen tietokehysten korjauskelpoiset virheet eli mallinteen tarkkuuden rajoittama määrä symboleja korjataan ja lasketaan virheluku, joka osoittaa edullisimmin korjattujen virheiden lukumäärän 24. Tämä suoritetaan molemmilla siirtoteillä.

10 Siirtoteille yhteisenä toiminteenä verrataan 25 valitun siirtotien virhelukua toiseen ja tarvittaessa vaihdetaan 26 vastaanottavaksi valittu siirtotie virheluvultaan ja/tai kellosignaalin vastaanoton lukitukseltaan parempaan. Lopuksi johdetaan 27 valittuna olevan siirtotien tietovirran käsittelysan tavut antojohdolle.

15 Kuviossa 3 esitetään lohkokaavio erään etenemisvarmennusjärjestelyn oleellisista osista. Sisäyksikkö (IU, Indoor Unit) 31 käsittää vaihtolaitteen (CD, Changeover Device) 32 etenemisvarmennetun tiedon vastaanottoa varten. Ensimmäinen siirtotie käsittää ulkoyksikön (OU, Outdoor Unit) OU1 33, antennit 34, 35 ja ulkoyksikön OU1 36. Siirtoteille yhteisenä nähdään oikealla sisäyksikkö IU 37 ja sen käsittämä vaihtolaite CD 38. Toinen siirtotie käsittää vastaavat laitteet 39, 40, 41, 42. Vasemmalta oikealle tapahtuvan siiron siirtotien valinta suoritetaan vaihtolaitteella 38 ja oikealta vasemmalle tapahtuvan siiron siirtotien valinta suoritetaan vaihtolaitteella 32. Ulkoyksiköt 33, 36, 39, 42 käsittävät välineet 33A, 36A, 39A, 42A kellosignaalin vastaanoton tahdistuksen tilan ja vastaanottavan tiedon virheluvun osoittavan signaalin muodostamista ja antamista varten.

25 Kuviossa 4 esitetään eräs tunnetun tekniikan mukainen vaihtolaite, jossa vaihdetaan kahden kellosignaalin CLK ja datasignaalin DATA paria. Katkoviivoilla 41 rajoitetut osat on toteutettu sovelluskohtaisella digitaalisella integroidulla piirillä (ASIC, Application Specific Integrated Circuit) ja niihin kuuluvat seuraavat osat: ensimmäisen signaaliparin CLK1, DATA1 vastaanottava joustava puskuri ELASTIC  
30 BUFFER 1, toisen signaaliparin CLK2, DATA2 vastaanottava joustava puskuri ELASTIC BUFFER 2, vertauskellosignaalin kanavointilaite REF MUX 44 sekä korrelaattori ja kanavointilaite CORR & MUX 47. Integroidun piirin ulkopuolella tarvitaan ainakin analoginen alipäästösuodatin (LPF, Low Pass Filter) 45 ja jänniteohjattu väärähtelijä (VCO, Voltage Controlled Oscillator) 46. Aktiivin puskurin 42 tai 43

kellosignaalin CLK2 yhden kellojakson ajan kuluttua hetkestä, jolloin kellosignaalien CLK1, CLK2 välinen vaihe-eron polariteetti on vaihtunut. Täten vaihe-ero on lohkon 65 annon nousuhetkellä lähes olematon tai  $180^\circ$ . Jos signaalit ovat samassa vaiheessa, voidaan ne vaihtaa keskenään lähes vaihesiirrotta pienen viiveen DL 66 5 jälkeen. Kellosignaalien vaihtoa kanavointilaitteella 68 ohjataan vaihdon kriteerit tarkastavalla lohkolla 67, joka saa ottosignaaleinaan vaihtoa pyytävän ohjaussignaalin, kellosignaalien kuvion "11" osoittavan signaalin ja kellosignaalien vaiheen käänymisen osoittavan viiveellä DL viivästetyn signaalin. Näiden kriteerien perusteella tiedetään, että signaalit ovat samassa vaiheessa eivätkä  $180^\circ$  asteen vaihesiirrossa. Viiveen DL tarkoitus on varmistaa, että kellosignaalien vaihto suoritetaan kellosignaalien ollessa vaihtohetkellä järjestelmän kannalta staattisessa tilassa eli 10 tilassa yksi. Tämä estää häiriöjännitepiikin aiheutumisen.

Kuviossa 7 esitetään eräs toinen keksinnön mukaiseen järjestelyyn kuuluva kellosignaalin vaihtolaite, johon kuuluu kuvion 6 esittämän ratkaisun lisäksi vaihdon 15 ajoittava toisen kellosignaalin CLK2 taajuuden nelinkertaistava analoginen vaihelukittu silmukka 71 (APLL, Analog Phase-Locked Loop). Silmukan 71 anto johdetaan vaihdon kriteerit tarkastavalle lohkolle 67. Kuviossa 6 esitettyä viivettä DL ei tässä tarvita APLL:n käytön ansiosta sillä, vaihtotila on viivästettäväissä käyttämällä taajuudeltaan nelinkertaistetun signaalin myöhempää vaihetta.

20 Kellosignaalien kuvion "11" osoittava lohko 61 on toteutettavissa esimerkiksi AND-portilla. Kuvion "01" tai "10" osoittava lohko 65 on toteutettavissa esimerkiksi XOR-portilla. Kuvion "10" osoittava lohko 86 on toteutettavissa esimerkiksi inverterillä ja AND-portilla.

Kuviossa 8 esitetään eräs kolmas keksinnön mukainen kellosignaalin vaihtolaite, 25 jossa signaalien välinen vaihe-ero todetaan enintään viiveen DL suuruisen aikaeron vallitessa. Kellosignaalin CLK1 ollessa vähän kellosignaalialla CLK2 edellä välittyy D-kiikkujen 81, 82 antotiloiksi yksi, mutta vaihe-eron kuitenkin alittaessa viiveen 83 DL ajan välittyy D-kiikkujen 84, 85 antotiloiksi nolla. Tällöin signaalien katsotaan 30 olevan riittävän tarkasti samassa vaiheessa ja vaiheilmaisin 86 saa ottoinaan D-kiikkujen 82, 85 antosignaalit tiloissa yksi ja nolla sekä antaa antonaan signaalin yksi. Analoginen vaihelukittu silmukka 71, vaihdon kriteerit tarkastava lohko 67 ja kanavointilaite 68 toimivat muuten samoin kuin kuvioiden 6 ja 7 tapauksissa, mutta lohko 67 huomioi vain silmukan 71, vaiheilmaisimen 86 ja ohjaussignaalit.

Toisiaan edellä esitetyissä kuvioissa 6, 7 ja 8 vastaavat osat on merkitty samoilla 35 viitenumeroilla asian selventämiseksi.

Kuviossa 9 esitetään esimerkinomaisesti erään tietokehyksen rakennetta. Tietokehys 91 alkaa lukitusbittisarjalla A, jatkuu peräkkäisillä data B / tarkistussumma C -parilla ja päättyy lukitusbittisarjalla D. Lukitusbittisarjat A, D ovat edullisimmin samalaisia ja niitä käytetään kehykseen lukittumista varten purettessa kehyksiä.

5 Tarkastellaan esimerkkinä erästä keksinnön mukaista etenemisvarmennettua radio-linkkiä, jossa virheenkorjausmenetelmänä käytetään RS (63, 59) -algoritmiä.

Molemmilla siirtoteillä ulkojyksiköissä OU1, OU2 lasketaan tarkasteluvälin pituisen tietovirran tarkistussumma (check sum) kertomalla tarkasteltava tieto RS (63, 59) -primitiivipolynomilla. Tarkistussumma lisätään tarkasteltavan tiedon perään. Tar-

10 kasteluväli on tässä 354 bittiä eli 59 tavua pitkä, kun tavoite on 6-bittinen. Tarkasteluvälin sisältämän hyötytiedon ja tarkistussumman muodostaman tietokehyksen pituus on 378 bittiä eli 63 tavua, josta tarkistussumman osuus on 4 tavua.

Muodostetut tietokehykset siirretään tässä kahta eri radiotietä, jotka ovat mahdollisimman eri tavoin alttiita häiriöille. Täten mahdolliset häiriöt aiheuttavat virheitä 15 yleensä vain yhdelle siirtotielle kerrallaan.

Vastaanotetut tietokehykset käsitellään vastaanottavissa ulkojyksiköissä OU1, OU2 jakamalla siirretty tietokehys generaattoripolynomilla, jolloin saadaan jakojäännös. Virheitä paikantava algoritmi käyttää jakojäännöstä virheiden havaitsemiseen. Vir-

20 heiden havaitsemisen lisäksi virheistä kyettiin korjaamaan tässä tapauksessa korkeintaan kaksi virheellistä tavua. Korjattavien tavujen suurin määrä on nostettavissa limityksellä (interleave) kahdeksaan tavoiteun asti. Tavut korjataan ja lasketaan virhe-luku, joka osoittaa, kuinka monta virhettä vastaanotetussa tiedossa oli. Ulkojyksiköissä OU1, OU2 muodostetaan tietokehys, joka sisältää korjatun hyötytiedon sekä virheluvun.

25 Sisäyksikkö IU vastaanottaa molemmilta ulkojyksiköiltä OU1, OU2 tietokehyksen ja vaihtolaite CD valitsee virheluvun perusteella paremman siirtotien hyötytiedon johtamiseksi edelleen antojohdolle.

Keksintää voidaan käyttää varsinkin plesiochronisen digitaalisen hierarkian (PDH, Plesiochronous Digital Hierarchy) mukaisten radioverkkojen linkkien varmentami-

30 seen. Tällöin esimerkiksi GSM-verkon radiolinkkien taajuudet vaihtelevat välillä 7 - 38 GHz, ja jopa 58 GHz on mahdollinen. Tällaisessa sovelluksessa hyötsignaali on plesiochronisen digitaalisen hierarkian (PDH, Plesiochronous Digital Hierarchy) datasignaali, jonka nopeus on yleensä 2 Mbit/s tai sen parillinen monikerta, mutta voi

olla myös ainakin 34 Mbit/s. Linkin pituus on sadasta metristä jopa useisiin kymmeniin kilometreihin asti.

Signaalin aktiivilla tilalla tarkoitetaan tässä, että signaalin kriteerit täytyvät. Siis signaalin tila on tosi tai edullisesti yksi. Signaalien tilat voidaan myös käantää, jolloin tilan "11" sijasta tarkkaillaan tilaa "00". Samalla tilalla tarkoitetaan kuitenkin tiloja "11" tai "00" ja eri tiloilla tiloja "01" tai "10".

Sisä- ja ulkoyksiköllä tarkoitetaan yksikön kuvaannollista asemaa järjestelmässä, eikä rajoiteta yksikön sijoittamista rakennuksen sisä- tai ulkotiloihin.

Siirtoteitä voi olla kaksi tai useampia.

10 Keksintöä ei rajata pelkästään edellä esitettyjä sovellutusesimerkkejä koskevaksi, vaan monet muunnokset ovat mahdollisia pysytäessä patenttivaatimusten määritelämän keksinnöllisen ajatuksen piirissä.

## Patenttivaatimukset

1. Menetelmä digitaalisen tiedonsiirron rinnakkaisen signaalien vaihtamiseksi, jossa menetelmässä siirrettävä tietovirta jaetaan useaan lähetykseen, **tunnettu** siitä, että
- 5 - valitaan ensisijainen siirtotie (21),
  - lasketaan käsittelyosan pituisen tietovirran tarkistussumma ja lisätään tarkistussumma tietovirran käsittelyosan yhteyteen (22) siirrettävän tietokehyksen muodostamiseksi,
  - siirtoteillä suoritetaan tietokehyksen siirto (23),
- 10 - vastaanotettujen tietokehysten korjauskelpoiset virheet korjataan ja lasketaan virheluku kullekin siirtotielle,
  - verrataan (25) valitun siirtotien virhelukua toisiin ja tarvittaessa vaihdetaan (26) vastaanotettavaksi valittu siirtotie virheluvultaan pienempään, ja
  - johdetaan (27) valittuna olevan siirtotien tietovuon käsittelyosan tieto antojohdolle.
- 15 2. Patenttivaatimuksen 1 mukainen menetelmä, **tunnettu** siitä, että tarkistussumma lasketaan kertomalla tietovirta mallintamiseen sopivalla polynomilla.
3. Sisäyksikkö (31, 37) digitaalista tiedonsiirtoa ja digitaalisen tiedonsiirron rinnakkaisen signaalien tietovuon valintaa varten, **tunnettu** siitä, että sisäyksikköön kuuluu ainakin vaihtolaite (38) etenemisvarmennetun signaalin vastaanottamiseksi ja
- 20 4. Patenttivaatimuksen 3 mukainen sisäyksikkö, **tunnettu** siitä, että vaihtolaitteisiin kuuluu
  - kanavointilaite (51), johon vastaanotettavien signaaliparien kellosignaalit johdetaan ja jolla valitaan vastaanotettava kellosignaali,
  - tietokehyksen purkulohkot (52, 53), joihin sekä kellosignaalit että datasignaalit johdetaan ja joissa signaaleista muodostetaan ohjaussignaalit sekä kehysistä puretut datasignaalit,

- joustavien puskureiden ja ohjauksen lohkot (54, 55), joihin ohjaussignaalit sekä kehyksistä puretut datasignaalit johdetaan ja joihin myös johdetaan valittu vastaanottettava kellosignaali tiedon ajoittamista varten,

5    - datasignaalien kanavointilaite (56), johon johdetaan datasignaalit joustavien puskureiden ja ohjauksen lohkoista (54, 55), ja

- purkulohko (57), johon johdetaan datasignaali datasignaalien kanavointilaitteelta ja jolla ohjataan datasignaalien kanavointilaitetta (56).

5. Patenttivaatimuksen 3 mukainen sisäyksikkö, **tunnettua** siitä, että sisäyksikkö (31, 37) on matkaviestinliikenteen radiolinkin osa.

10 6. Ulkoyksikkö (33, 36) digitaalista tiedonsiirtoa ja digitaalisen tiedonsiirron rinnakkaisten signaalien tietovuon valitsemista varten, **tunnettua** siitä, että ulkoyksikköön kuuluu ainakin siirrettävän signaalin lähetävä lähetin sekä vastaavasti signaalin vastaanottava vastaanotin ja välineet (33A, 36A) vastaanotetun signaalin virheluvun laskentaan sekä edelleen virheluvun osoittavan tiedon antoon.

15 7. Patenttivaatimuksen 6 mukainen ulkoyksikkö, **tunnettua** siitä, että ulkoyksikkö (33, 36) on matkaviestinliikenteen radiolinkin osa.

8. Järjestely digitaalisen tiedonsiirron rinnakkaisten signaalien vaihtamiseksi, johon järjestelyyn kuuluu ensimmäinen sisäyksikkö (31) tietovuon jakamista varten, antennit (34, 35, 40, 41) rinnakkaisten signaalien lähetämistä ja vastaanottamista 20 varten ja toinen sisäyksikkö (37) tietovuon valintaa varten, **tunnettua** siitä, että siihen lisäksi kuuluu

- ensimmäinen vaihtolaite (32) ensimmäisessä sisäyksikössä (31) ja toinen vaihtolaite (38) toisessa sisäyksikössä (37) etenemisvarmennetun tiedon vastaanottoa varten, ja

25 - ensimmäinen (33) ja toinen (36) ulkoyksikkö, joissa on välineet (33A, 36A) lähetettävän tiedon mallintavalla sekä vastaavasti vastaanottavan tiedon tarkastavalla ja virheenkorjaavalla algoritmilla käsittelyä varten.

9. Patenttivaatimuksen 8 mukainen järjestely, **tunnettua** siitä, että tiedon mallintaava algoritmi on kertova polynomi.

30 10. Patenttivaatimuksen 8 mukainen järjestely, **tunnettua** siitä, että vaihtolaitteisiin kuuluu

- kanavointilaite (51), johon vastaanotettavien signaaliparien kellosignaalit johdeetaan ja jolla valitaan vastaanotettava kellosignaali,
- tietokehyksen purkulohkot (52, 53), joihin sekä kellosignaalit että datasignaalit johdetaan ja joissa signaaleista muodostetaan ohjaussignaalit sekä kehyksistä puretut datasignaalit,
- joustavien puskureiden ja ohjauksen lohkot (54, 55), joihin ohjaussignaalit sekä kehyksistä puretut datasignaalit johdetaan ja joihin myös johdetaan valittu vastaanotettava kellosignaali tiedon ajoittamista varten,
- datasignaalien kanavointilaite (56), johon johdetaan datasignaalit joustavien puskureiden ja ohjauksen lohkoista (54, 55), ja
- purkulohko (57), johon johdetaan datasignaali datasignaalien kanavointilaitteelta ja jolla ohjataan datasignaalien kanavointilaitetta (56).

**(57) Tiivistelmä**

Keksinnön tarkoituksesta on esittää parempi varmennetun tiedonsiirtolinkin rinnakkaisten siirtoyhteyksien vaihtomenetelmä ja -laite. Keksinnön mukaisella tavalla vastaanotettava siirtotie vaihdetaan ennen virheiden läpäisyä ja linkin tiedonvälitys säilyy virheettömänä, mikäli edes yksi siirtoteistä välittää tiedon virheettömänä, vaikka muissa aiheutuu virheitä. Linkin virheettömyys säilyy myös virheettömän ja virheellisen tiedonsiirtotien vaihtuessa äkisti keskenään. Tämä toteutetaan laskemalla siirtoteille yhteisen sisäyksikön (IU, Indoor Unit) jälkeen rinnakkaisissa ulkoyksiköissä (OU, Outdoor Unit) virheenkorjauksen mahdollistava korjattavan tarkasteluvälin tiedon tarkistussumma, tarkastamalla vastaanottavissa ulkoyksiköissä tiedon virheettömyys tai korjaamalla korjauskelpoiset pienet virheet sekä valitsemalla vastaanottavassa sisäyksikössä ulkoyksiköstä annetun virheettömyyttä esittävän hyvyysluvun perusteella virheettömämpi siirtotie, mikäli esimerkiksi sääolot aiheuttavat virheitä käytettäväällä yhteydellä.

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**REPLY TO WRITTEN OPINION**  
**INTERNATIONAL PATENT APPLICATION PCT/FI00/00280**  
**APPLICANT: NOKIA NETWORKS OY**  
**Due Date: 20 May 2001**

In response to the Written Opinion mailed on 21.3.2001 we file amended claims and respectfully present the following.

Amended claims 1, 3, 6 and 8 now specify that the digital transmission occurs over a radio link, that the method is applied on a hop-by-hop basis. Support for this amendment is on page 1, line 6 and page 2, line 18. Furthermore, the amended claims specify that a clock signal is changed over after waiting for a sufficiently accurately cophasal clock signals. Support for this amendment is on page 7, lines 18-20 and page 8, lines 22-24. The dependent claims remain unchanged.

Publication D1 discusses protection of a transmission path, not protection applied on a hop-by-hop basis. Operation on hop-by-hop basis provides better protection. Publication D1 mentions various problem situations, see for example claims 8, but discusses only transmission of data when mentioning change of transmission paths. The changing of transmission paths involves typically changing of clock signals, and the clock signal needs to be changed at a carefully chosen time.

The amended claims define features, which are not disclosed in presented prior art and which are inventive over presented prior art. A reconsideration of the Written Opinion is therefore respectfully requested.

The description (pages 3, 4 and 4a) is amended to keep the claims and description in conformity. The amendments on enclosed pages 3, 4 and 4a are identical to those in the enclosed claims.

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A further replacement page 1 is also enclosed. On page 1, line 12 a translation error (availability instead of usability) is corrected.

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Sirpa Kuisma  
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Encls. Replacement pages 1, 3, 4, 4a, 11, 12 and 13

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**Method and arrangement for changing parallel signals in a digital data transmission**

The invention relates to a method and arrangement for changing parallel signals in  
5 the propagation assurance of digital data transmission, particularly for realising the propagation assurance of radio links. Said signals include clock and data signals. The invention is suited to other data transmission connections as well, for instance to connections using optical transmission paths.

10 The quality requirements for a digital radio link are generally known; said requirements are set for example by the ITU, International Telecommunication Union. The quality requirements refer to the reliability and interference-free quality of the transmission. The most important features are availability, error ratio and phase noise. Among the factors that affect the fulfilment of said criteria are hardware malfunctions, weather and changes in the signal path. In order to fulfil  
15 the requirements, it is necessary to provide an equipment and propagation assurance for the radio link. By means of equipment assurance, there is obtained a more reliable usability, and by propagation assurance, there is obtained both a lower error ratio, a lower phase noise and better operational features.

20 Figure 1 is a block diagram illustrating one target of propagation assurance. A public switched telephone network (PSTN) 11 is connected by wires to a mobile switching centre (MSC) 12. The security of the radio link between the switching centre 12 and the base station controller (BSC) 13 is extremely important, wherefore it is generally assured. The controller 13 is further connected, by radio  
25 connections which can also be assured, to base telecommunication stations (BTS) 14, 16, 18 and to their antennas 15, 17, 19.

30 The propagation assurance of radio links is realised by means of one or several parallel radio connections. Now in parallel with the major radio connection, there is constructed one or several other backup transmission paths that carry the same information. The transmission paths are preferably different, in order to prevent possible interference caused by the terrain and/or weather changes from affecting both paths at the same time. Among the transmission paths, there is selected the one that has, in the prevailing conditions, a better signal at the station receiving the radio link. The applied criterion for the selection is generally the signal strength, but also the correctness of the parity of the received information. The changing of

The invention relates to a method for changing parallel signals in digital data transmission over a radio link, in which method the data flow to be transmitted is divided into several transmissions. According to the invention

- there is selected a primary transmission path,

5 - in the transmission paths there is calculated a check sum for the data flow of the length of the processed section, and the check sum is added to the processed section of the data flow in order to form a data frame to be transmitted,

- in the transmission paths, there is carried out the transmission of the data frame,

10 - correctable errors of the received data frames are corrected, and the error sum in the transmission paths is calculated,

- as an operation common to the transmission paths, the error sum of the selected transmission path is compared with the other paths and when necessary, the transmission path selected as the one to be received is changed over to a path with a smaller error sum,

15 - a clock signal is changed over after waiting for a sufficiently accurately cophasal clock signals, and

- the information of the data flow of the processed section of the selected transmission path is conducted to the output cable.

20 The invention relates to an indoor unit designed for digital data transmission over a radio link and for the selection of the data flow of parallel signals in digital data transmission. According to the invention, the indoor unit comprises a changeover device for receiving and changing the signal on the basis of an error sum obtained from an outdoor unit, said changeover device being arranged to change clock signals after waiting for sufficiently accurately cophasal clock signals.

25 The invention relates to an outdoor unit designed for digital data transmission over a radio link and for the selection of the data flow of parallel signals in digital data transmission. According to the invention, the outdoor unit comprises a transmitter for transmitting the signal to be transmitted and respectively a receiver for receiving the signal, as well as the calculation of the error sum of the received signal and further the outputting of the information indicating said error sum to the indoor unit.

The invention also relates to an arrangement for changing parallel signals in digital data transmission over a radio link, said arrangement comprising a first indoor unit, antennas for transmitting and receiving both parallel signals and a second indoor unit. According to the invention, it also comprises

- 5 - a first changeover device in the first indoor unit and a second changeover device in the second indoor unit for receiving the propagation assured data, said changeover devices being arranged to change clock signals after waiting for sufficiently accurately cophasal clock signals, and
- 10 - in both transmission paths, a first and second outdoor unit for processing the data to be transmitted by a modelling algorithm and respectively for processing the data to be received by a checking and error-correcting algorithm.

According to the invention, the changing of the transmission path is carried out always when a better data frame is received from the other path. Thus the changing is carried out frame by frame, by comparing the number of errors occurring in two or more parallel data flows.

The changeover device can be fully realised by means of an application specific integrated circuit (ASIC).

The preferred embodiments of the invention are set forth in the independent claims.

The invention is described in more detail below, with reference to the accompanying drawings, where

figure 1 is a block diagram illustrating a service environment of propagation assurance according to the invention,

figure 2 is a flow diagram illustrating a method according to the invention,

figure 3 is a block diagram illustrating an arrangement according to the invention,

figure 4 is a block diagram illustrating a known signal changeover device,

figure 5 is a block diagram illustrating a changeover device applying a clock signal multiplexer according to the invention,

figure 6 is a block diagram illustrating a clock signal multiplexer according to the invention,

4a

figure 7 is a block diagram illustrating another clock signal multiplexer in an arrangement according to the invention, and

figure 8 is a block diagram illustrating a third clock signal multiplexer in an arrangement according to the invention, and

5

**Claims**

1. A method for changing parallel signals in a digital data transmission over a radio link, in which method the data flow to be transmitted is divided into several transmissions, **characterised** in that
  - 5 - there is selected a primary transmission path (21),
    - there is calculated a check sum for the data flow of the length of the processed section, and said check sum is added to the processed section of the data flow (22) in order to form a data frame to be transmitted,
    - in the transmission paths, there is carried out the transmission of the data frame (23),
      - 10 - correctable errors in the received data frames are corrected, and an error sum for each transmission paths is calculated,
      - the error sum of the selected transmission path is compared (25) with the other paths and when necessary, the transmission path selected as the one to be received
      - 15 - changed over (26) to a path with a smaller error sum,
      - a clock signal is changed over after waiting for a sufficiently accurately cophasal clock signals, and
      - the information in the data flow of the processed section of the selected transmission path is conducted (27) to the output cable.
  - 20 2. A method according to claim 1, **characterised** in that the check sum is calculated by multiplying the data flow by a polynome suitable for modelling.
  3. An indoor unit (31, 37) for digital data transmission and for selecting the data flow for parallel signals in digital data transmission over a radio link, **characterised** in that the indoor unit comprises at least a changeover device (38)
    - 25 for receiving and changing a propagation assured signal on the basis of an error sum obtained from an outdoor unit, said changeover device being arranged to change clock signals after waiting for sufficiently accurately cophasal clock signals.
    - 30 4. An indoor unit according to claim 3, **characterised** in that the changeover devices comprise

- a multiplexer (51) whereto the clock signals of the signal pairs to be received are conducted, and whereby the clock signal to be received is selected,
- data frame decoding blocks (52, 53) whereto both the clock signals and the data signals are conducted, and where said signals are formed into control signals and data signals decoded from the frames,

5

- elastic buffer and control blocks (54, 55) whereto the control signals and data signals decoded from the frames are conducted, and whereto the selected clock signal to be received is conducted in order to synchronise the data,
- a data signal multiplexer (56), whereto the data signals are conducted from the elastic buffer and control blocks (54, 55), and

10

- a decoding block (57) whereto a data signal is conducted from the data signal multiplexer, and whereby the data signal multiplexer (56) is controlled.

5. An indoor unit according to claim 3 or 4, **characterised** in that the indoor unit (31, 37) constitutes part of a radio link in a mobile telecommunications system.

15

6.. An outdoor unit (33, 36) for digital data transmission over a radio link and for selecting the data flow for parallel signals in digital data transmission, **characterised** in that said outdoor unit comprises at least a transmitter for transmitting the signal to be changed and respectively a receiver for receiving said signal, and means (33A, 36A) for calculating the error sum of the received signal and further for outputting the information indicating said error sum.

20

7. An outdoor unit according to claim 6, **characterised** in that the outdoor unit (33, 36) forms part of a radio link in a mobile telecommunications system.

8. An arrangement for changing parallel signals in digital data transmission over a radio link, said arrangement comprising a first indoor unit (31) for dividing the data flow, antennas (34, 35, 40, 41) for transmitting and receiving parallel clock signals and a second indoor unit (37) for selecting the data flow, **characterised** in that said arrangement also comprises

25

- a first changeover device (32) in the first indoor unit (31) and a second changeover device (38) in the second indoor unit (37) for receiving the propagation assured data, said changeover devices being arranged to change clock signals after waiting for sufficiently accurately cophasal clock signals, and

30